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LOGIC AND REALITY[1]

SOMEBODY said, "Doesn't he look intelligent!" I turned and saw in profile, across the crowded room, Morris R. Cohen in animated conversation. I have always been rather proud that one who looks, and really is, so intelligent should have opinions so close to my own. Perhaps a reviewer of opposing views would be better for this book. I have to stop and think up points on which to disagree. As for the book itself, this is not a book on logic. It is a book about the place of logic in the sciences and modern life. It has been widely and favorably reviewed in the popular periodicals, with a hint that maybe there are a few technical terms. Technical terms are today an asset in a book for the public, like the old lady who read Eddington's books "with ever increasing delight, just because she didn't understand a word of them." But the difficulty with Professor Cohen's subject is that he writes of things so close to our daily thought that we have never stood back far enough to look at them squarely. For me Professor Cohen has kept his popular audience too well in mind, and cut himself short with a sentence just where I would like a chapter. Others have told me they wished he had said more on ethics, or on the logic of metaphor. I wish he had said more on logic.

The book covers a wide field. There is first the discussion of formal logic, as the logic of "the possible" rather than the logic of thought. It defines the nature of the possible. "Two plus two equals five," is not possible. Then there is a discussion of twilight zones in concepts and of the logic of fictions, followed by the nature of probability and the statistical view of nature, and finally the relation of logic to values and ethics, and to the total world order. A reprint of two popular reviews of Francis Herbert Bradley and John Dewey fills out the two hundred pages—quite a lot of subjects for so small a book.

I feel that to review properly the questions raised by Professor Cohen would call for a book rather larger than his. All I can undertake is to try to clarify some distinctions that seem to me worth making. Even this will take too much space. If I speak often of my personal reactions, it is not to indicate any conceit of

[1] A review of *A Preface to Logic* by Morris Raphael Cohen. New York: Henry Holt & Company, 1945, xi + 209 pp., $2.50.

mine, but rather the tentativeness of the inquiry. Since I do not try to present all the relevant considerations, even as they appear to me, I lay myself open to a refutation like that Professor Royce once got in Scotland. After presenting what he thought was a rather cogent and profound discussion before a philosophical assemblage, Royce sat back to await questions. None came, until finally a little Scotsman spoke up sharply from the far corner: "I have been thinking over what the learned visitor has said, and I have come to the conclusion that there is nothing in it."

I

First let us consider possibility. There are at least four senses in which the term is used: ignorance-possibility, essential possibility, existential possibility, and potentiality.

The reduction of all possibility to ignorance has been made most explicitly, among authors known to me, by Bosanquet. We do often say, "That is possible, I really do not know." Bosanquet held that for the Absolute there would be no possibilities, only actuality. I doubt if even the Absolute Idealist can hold entirely to this, and it was certainly most vigorously denied by Royce. Bosanquet, I take it, was thinking in terms of a refusal to separate "the what" and "the that." But Spinoza, for instance, makes the separation, for finite things, basic in his argument. The essence of no finite thing contains the reason for its existence, though there is a reason in the great system of things "for the things that are, that they are; and for the things that are not, that they are not." Spinoza seems to hold that although not everything that is in some sense possible exists, everything that is existentially not impossible does exist.

Bradley might be considered as agreeing with Bosanquet, since Bradley says Reality is the ultimate subject of every judgment. So, to seem to make a judgment about the possible is really to make a judgment about Reality. But let us take one of the stock examples used by Bosanquet and Spinoza, a classic philosophical illustration: "The angles of a [Euclidean] triangle are equal to two right angles." This proposition is presumably not now thought true of our physical non-Euclidean space-time world, so I do not see what Reality it can be supposed to characterize except itself.

Santayana would call such possible objects *essences*. Others would use the terms *subsistences* and *abstract possibilities*—terms I do not altogether like. I remember, as I listened years ago to Santayana lecturing on essences, hearing him say, "Essence is worth considering because it has structure, a systematic form." And I remember my immediate reaction, "Yes, there are essences

that have structure and equally essences that do not." Essences are multifarious beyond all measure. Whatever may be the truth about "real" angels, there are possible angels that are male, and angels that are female, possible angels with wings and angels without wings. In this universe of discourse only particular affirmative propositions are true, since to every possible rule there is the possible exception, or perhaps it involves a contradiction to say even this.

Yet it seems to me there must be a more limited region among essences, concerning which true universal and negative statements can be made, and meaningful denials. It is the region in which all the non-Euclidean geometries are found. It is the region in which one can assert it to be true, that in a four-dimensional space we could turn a rubber ball inside out, or turn over a left-hand glove and put it on the right hand, but in which we could not spin a top, or make certain sorts of knots hold tight. It is the region of what Leibniz called "the compossible." Professor Cohen says "incompatibility" is as much a fact of our world as any other fact, and I agree. Incompatibility is itself, of course, a relation not verifiable by the senses. One at least of the incompatibles must remain only a possible thing. This region of the possible, where there are general truths but not existence, I have called "essential possibility." It is only within this region that essences become interesting, as Santayana says, because systematic.

It may be asked whether essential possibilities are not of the nature of inventions, based on rules of the game as we choose to play it. We certainly do not arrive at them by passive observation, and if the alternative to observation is invention, so be it. Only let us not assume we are free from all restraint when we invent. A symphony is a great invention, but months of filing and polishing are needed to bring it to perfection. An airplane engine is an invention, but the technician talks in terms of tolerances of a ten-thousandth of an inch, of measurements to the millionth of an inch. The English language is an invention, and a great one, but you have to treat its ways with respect. Even the inventions of fiction have idiosyncrasies of their own. I once heard of a woman who entertained the novelist Thackeray. He spent the night in the house, and reappeared the next morning in a very bad humor. The hostess was in despair. Was it the bed, the room? "Madam," he said, "you are in no wise to blame. It is that idiotic Colonel Newcome, who has again been making a damn fool of himself." When the instrumental logician says logic is an invention, I am not opposed to that, but to the further assumption that formal relationships can be postulated at will, and then dis-

regarded or annulled. Such an instrument calls for higher precision than an airplane engine. A celestial museum of possibilities, among which one rides with chariot and winged horses (or a jeep), is not a very helpful assumption. But the fact remains that the value of essential possibilities resides in the aspect that is found, rather than that which is postulated by arbitrary fiat. We may choose to talk, or not to talk, of perfect circles or four-dimensional space. But we have no choice about the value of *pi*, or the possibility of spinning a top in four dimensions.

Professor Royce's "rational voluntarism" described "the real" as a choice among possibles, like Leibniz. But Royce did not want the possibles to be too real, and therefore maintained there were no individuals among the possibles, but only "classes-of-one." This is difficult to reconcile, for instance, with the "extensional" quality of symbolic logic, where a dyadic relation R is identified with the sum of the pairs of objects supposedly related by R. Must these pairs be always "real," and not possible objects? How, then, can we deal with alternative systems, not all of which can be empirically real? One trick is to make up a system of numbers satisfying the axioms. But a number, say the number 5 (noun), is identified with the class of all the classes which are one-one similar with a given class of five (adjective) members. Are these all classes of actual existents? If there happened to be only 100 actual existents, then 101, 102, etc., collapse into a monotonous null-class. Number ought not to be so dependent on the accidents of physical fact. And besides, existent things do not take number directly, as Frege and others have pointed out. Yonder object is not "one." As a tree it is one; but as trunk and branches it is many; as leaves many hundred thousand; as cells or molecules enormously numerous. The objects of mathematics, or so it would seem, must needs be objects that are "essential possibles," rather than real existences, but they should also be individual or separate units.

An object of geometry, such as a *point*, would seem to be also an "essential possible." It is true the nominalist theory of Russell and Whitehead would try to replace, let us say, an unobservable point, on a surface, by a series of converging "observable" areas, using "the method of extensive abstraction." But in general, at the place where we want the point, there is no such observable series—as any child can tell you. And the elements of the imaginary series, being infinitely sharp in contour, are each and all totally unobservable idealizations of actually observable areas. These ideal areas are thought of, and not observed. They are essential possibilities—they may even be existential possibilities.

But the method, considered as a nominalist device for reducing "ideal" entities to "observable" entities, should be called "the method of extensive humbug."

The next class of possibles, "existential possibilities," are things possible in our world. Assertions about them usually amount to declaring that conditions, more or less complete, for their existence actually exist. Such assertions often admit of degree, as when we say, "It is quite possible," or "It is barely possible," or "It is impossible in our physical space." Something may be entirely possible without being probable, as, for instance, throwing double sixes. It seems to me highly desirable to distinguish the existentially possible from the essentially possible.

To me the most interesting type of existential possibility is "potentiality." For some reason Professor Cohen says (p. 180) potentiality belongs to essence and not to existence. I am disposed to make it part of the very "essence of existence," if I may so speak. Attempts to define "existence" as anything which has a place in the space-time system referred to by physical science either give that thing an internal relation to an absolute and prior space and time, or ascribe to it the possibility of causal interacting with other things, and the latter possibility is potentiality. Potentialities are not purely internal, though they are that, but are called forth by other things, by circumstances. Unlike other types of possibility, potentiality is peculiarly a temporal concept, a causal concept. It seems to me a thing is to be called "really existent" when, first, it belongs to more than one system, linking systems to one another which otherwise might not be mutually relevant, and when, secondly, it has internal resources in the way of potentialities, of surprise to those who think they know it best. The chief reason for believing in some form of "substance" is the existence of potentiality. A substance is, to paraphrase Mill, "a permanent potentiality of sensation and action." "Potentiality" sounds very *metaphysical*, and the word is doubtless offensive to positivists. But in its simpler forms potentiality is commonplace enough. "Yonder stone is hard," that is, it would, under certain circumstances, resist pressure. I would like sometime to meet a real positivist, one who never uses a word ending in *-able*. "Observable" and "verifiable" are of course potentiality concepts. But I think I have said enough to make my distinctions clear.

II

Let us next consider certain questions about truth. To the beginner in logic the distinction between validity and truth is always a bit surprising. It is surprising, for instance, that it is possible

by valid argument to arrive at a true conclusion from false premises—how can truth come out of error? By the symbolic logician truth and falsity of propositions (or perhaps statements or sentences) are manipulated in a way to suggest the early view of Russell and Moore, "some propositions are true and some false just as some roses are red and some white." Invert them, and the calculus works quite as well. Yet thoughtful students of epistemology have doubted whether we have very much assured truth, and even whether truth can be enclosed at all within the four corners of what can be stated in a sentence. It seems to me, on the contrary, that truth is one of the easiest things to come by in this world, that there are enormous numbers of truths, some of them spilling over even into the newspapers and the quiz programs. Truth, *per se*, is of very little value. What science wants is a certain sort of truth. But let us examine the contrary view and the reasons for it.

It is best to begin any such inquiry always with an example, for instance (Professor Cohen, p. 31), "Gold is yellow." One view may be rejected at once, in spite of Locke. It will not do to say, "Gold is yellow, for that is what I mean by gold," or "The whale is a fish, for that is what I mean by a whale." It is not convention that we seek, but fact.

But gold is not yellow in the dark or under a blue light. We must specify the conditions. This leads to other conditions of the conditions. And like the "flower in the crannied wall" we may end up with the nature of God and man. There is no truth but the whole truth. But Mr. Francis Bradley, who has pursued this thesis to its culmination, concludes that "whole truth" is itself, in the last analysis, contradictory, and leads over to something beyond truth. Meanwhile "gold is yellow" becomes for us "gold is yellow under conditions x, unspecified," and this seems to be a propositional function, incomplete, neither true nor false. Bradley suggests that some propositions are truer than others, because needing less supplementation, in the final complete truth. But the complete truth, even if it existed, is infinitely far away from any finite truth—so can any of them be nearer? Joachim suggests that our truth consists in the realization that finite truth is imperfect. As Russell put it, if Joachim asserted absolutely that the late bishop died in his bed or wore episcopal gaiters, this would be false; but if Joachim asserted, while clearly realizing that finite truth is imperfect and needs supplement, that the late bishop was hanged for murder, this would be the best that finite truth could be. This way out also clearly will not do.

Why not say, "gold is yellow" means that "there are condi-

tions under which gold is yellow," not trying to specify what conditions? There are. Yes, you would then have truth. But also "gold is green," "gold is blue," under this interpretation, will be equally true. Almost every statement you could make, including "gold is not yellow," would be just as true. Clearly we must leave room somewhere for denial as well as affirmation, error as well as truth. But we are coming closer. This is the way we actually do get many of our truths, and also the reason why they are not worth much.

An animal runs across the road down ahead. If I confine myself to saying, "Something moved down ahead," I have an excellent chance of hitting the truth. But if I grow more definite and claim it moved across the road, or that it was an animal that crossed the road, that the animal ran across the road, or that it was a fox, it was a particular kind of fox—at each more exact specification the chance of error increases. In other words, the way to reach truth easier is not by piling on specifications like Bradley, but by taking them off. The vaguer the statement, the more likely to be true. The whole Bradley approach is the inverse of what we need to take, if it is just truth we want. "Gold is yellow" is true because we do in practice supplement it somewhat vaguely with conditions, partly specified, partly left indefinite, "normal eye" and "normal lighting" and so on, something wider than my present observation and purpose, vaguely wider yet running some risk of error. The way to be tolerably sure of the truth is not to be too specific. A statement such as "gold is yellow" is significant if it has run some risk of being found in error, and true if it has stood comparison with observed fact, on the level of definiteness or vagueness to which it aspires. So I come back to my original comment, that the p and q of the symbolic logician, which are in themselves true or false, are not the truths of actual daily usage; but also, that mere truths are a dime a dozen and not worth much when you get them. In other words, science is not the search for truth, but for a special kind of truth.

The confusion in the uses of the term "generality" is one of the most troublesome in all philosophical inquiry. The biologist speaks of the evolution of the individual as proceeding from the general to the specific; the logician of the inverse relation of extension and intension (as if, as Cohen remarks, Parisian were a more meaningful term than Frenchman); the man in the street has a scorn for vague abstractions and empty generalities. As a matter of fact, the movement of thought is not from the general to the specific, or the reverse, but from the vague and ambiguous to the general which is also specific. The Hegelian use of the term

"concrete universal" is, I think, misleading, but it shows an appreciation of the facts I have in mind. The main movement of inductive thought is one towards "specific generalization," perhaps best illustrated in mathematical generalization, which is the main movement of mathematical thought. It would be a great confusion to identify specific generalization with the "inductive leap" of the ordinary textbooks from "some" to "all"; the latter is something quite different, a species of probable inference. "Specific generalization" may seem a paradox, even a self-contradiction, and still more startling is the making of mathematics in this respect the typical inductive science. If I talk in paradoxes, it is because I seek to follow the facts rather than linguistic usage.

The concept of the "vague," and its subspecies, need more analysis than I can enter upon here. It is not, I think, identical with meagreness of implication. Fertility of implication belongs to systems and key centers of systems. Remarks such as "A fog is definitely what it is, and not vague" seem to bring up false analogies. The characterization of science as a series of closer and closer approximations towards reality indicates one aspect of the escape from vagueness. But the introduction of the quantum theory and the advance from Newton to Einstein were not purely questions of an extra decimal place, though an extra decimal place might be involved. What is being sought includes greater exact detail and precision of analysis, greater fertility of inference, new points of verifiability—more specific generalization. A theory may even be false and yet be on the road of progress, if it possesses these characters. As Bacon and Huxley have said, "Truth comes sooner out of error than out of confusion." But a residuum of vagueness hangs over the most exact statement that we can make. One may know that "two plus two equals four," and still be under some misapprehension, such as that a reference to the number 2 occurs in this proposition, or even to a pair of them.

III

The up-to-the-minute young student of philosophy will doubtless be a behaviorist and a positivist. *Qua* behaviorist he will believe that sense-data are products of complex reactions between organism and environment, different for different individuals, therefore subjective and impossible to compare; and introspective psychology, which deals with such imponderables, can never be a science. But as a positivist he will believe that sense-data are *all* there is that is verifiable, nothing not made of them is observable and indubitably given, and anyone who talks of something different is a metaphysician in the bad sense. In short, our young phi-

losopher is like a person who sees white with the right eye and black with the left, and a dizzy lustre effect with both eyes. To keep from being put out of countenance by this philosophical brand of retinal rivalry, he is likely to proclaim in a loud voice that anyone who claims he sees things differently from behaviorism plus positivism is indulging in meaningless verbalization.

There are those who see things rather differently. The instrumental logicians, if I understand them aright, say sense-data are inventions, inventions made to verify hypotheses—at least those sense-data which are most important for science. At any rate, I hope they mean this. Again, the paradox is in the language rather than the fact. By inventions I do not mean fantasies, like pixies and gremlins, but something rather solid, like an automobile, which is also an invention. I do not mean merely that sense-data are cut out of a larger continuum, or that they are used as signs. I am speaking of their very existence, at least as part of our experience. We are active even in ordinary sense-perception, adjusting our eyes to see, moving a hand out to feel, clarifying our perception by being attentive. But in the experiments by which I verify an hypothesis, I actively rearrange and get what I want. The products of experiment are manufactured products. In doing this I realize, indeed, a potentiality already there, and when it comes it contains parts I did not altogether expect. I know by that sign that I have bit into reality, just as the "bugs" in new styles of automobile engines stubbornly make us aware they are real things and not products of pure fantasy. The old philosophical axiom, deceiving even Kant, that what we create we know through and through, is as regards inventions radically false. But why do we create these sense-data by experiment? In order, by actualizing these existential possibilities, to find out what are the conditions under which they arise, what are the potentialities there are in the world.

The invention of sense-data is not the end-product of the process of verification. The process ends in thought, not action. Here I differ from what the instrumental logicians regularly say. That all logic is instrumental in a wider sense is something no one can dispute. That a process of thought always terminates in action is much more disputable.

We can imagine a case where thought seems to end in action. A hole in the fence presents a problem. Pieces of wood in a pile suggest themselves as ways of blocking off the neighbor's chickens. I look at one likely board. It will not fit, but I think, "Upside down it would go in very nicely." I turn it around and in it goes, and experience flows free without further thought. Hypothesis,

deduction, verification, and the process is done. But also one has not learned anything. When we have made a real experiment, on the contrary, it is always necessary to see further what can be inferred and learned from the experiment. We have to draw a conclusion. It is most unhappy that the word "verification" has got attached to experiment, as if that were an end in itself.

Let us take examples. The physicist forms a theory or hypothesis about electrons and protons. He who does not work with a guiding hypothesis is likely to be trapped into false generalizations by the first supposed facts he meets. In any case he does not know where to look for the facts that will be informative. The hypothesis can not usually be directly tested; in this case electrons and protons are beyond direct observation. The physicist therefore deduces from the theory consequences which are potentially observable. That is, he invents a proof that these consequences do follow from the theory. He further devises, or invents, arrangements by which sense-data connected with these consequences may be observed, and he brings into being these data. These sense-data may pre-exist; we are not discussing metaphysics. I would myself say that if created, they are not created by the knowing of them, but by arranging magnets and vacuum pumps and photographic plates. What we thus get are certain "new" sense-data. But these are not the protons and electrons of the theory. To get back to protons and electrons we need a further process of thinking. This last, if anything, is the stage of verification, and it is a process of thought, not a process of action. And, I may add, it is not a simple hypothetic syllogism, saying: hypothesis is so-and-so; if hypothesis, then consequences as follows; consequences are found to be existent; therefore hypothesis is true. This syllogism is plainly invalid. The real thought process here is more complex, involving a comparison of essential possibilities and incompatibilities.

Or take another case. Professor Dewey has suggested that we can see most clearly the nature of all judgment, and how it leads to action, if we consider judgments about practice. I grant that a judgment such as, "If you touch that booby-trap, it will explode," may have a considerable practical importance. But its truth is that of any other causal judgment about potentialities. A more characteristic judgment about practice, to be tested by experience, would be a judgment concerning a choice of the better and the worse. I make, let us say, the judgment that way of action *A* is better than way of action *B*. They are assumedly incompatible ways. Therefore I try to test one of them, *A*. It succeeds. But does that exclude that *B* might have succeeded better? No.

So I do both of them, under similar conditions at different times. Do I thereby prove that *A* is better than *B*? No. I have no conclusion yet, until I have added to my actions a process of thought, a process of comparison, by which I convince myself that *A*, as thus tried out, was preferable to *B*, as tried.

In other words, a process of using hypothesis, whether practical or theoretical, with appeal to confirmatory experience, if one is really to learn anything from it, ends in thought, not in action. And Dewey has rightly insisted that all problem-solving is use of hypothesis. Yet the name "instrumental logic" suggests that thought is to be considered as always a passing stage, one which ends in a plunge back into "concrete experience," whatever that may be. This is, I believe, a mistaken view. The sense-data of active observation and experiment are themselves useful prepared material, by aid of which thought can reach better conclusions. I am not denying, of course, that most people are eager to escape from the irksomeness of thought as soon as possible, and truly cogent reasoning is "as difficult as it is rare."

IV

At last we are ready for a few comments about the relation of sorts of logic to the world in which we live. There are at least three main sorts of logic: a general science of order and form, a noetic logic of thinking, and, lastly, scientific methodology. Symbolic logic overlaps the first two.

The second of these, the logic of thinking, is a derived and applied science. Originally, with Aristotle, it was the logic by which one convinced somebody of something. It has come down to us as the content of the elementary logic text. It is a confused subject, itself infected with the vagueness of ordinary thinking. I remember feeling this strongly when I read Alfred Sidgwick's exposition of the application of general propositions to cases, and his contention that there lurks in the background always the possibility of a fallacy of accident. "Thou shalt not kill," therefore, "capital punishment is wrong." I became convinced there can be no such thing as an exact formal logic of ordinary thinking, though some study of logic may help to clear up the worst cases of fallacy and ambiguity.

Every student of logic should read such a text as Joseph's, and above all work his way through the elder Keynes's book, *Studies and Exercises in Formal Logic*. Keynes may be old-fashioned, but the student ought to know him, if only to avoid rediscovering his distinctions all over again, or falling into the confusions he warns against. Often our (non-symbolic) textbook writers have not done

this, and repeat useless and false technicalities, till the subject becomes, as Bertrand Russell called it, "a training in those habits of solemn humbug which are of such great use in later life." I used to loathe the job of trying to unteach what students got out of such texts. Why should they believe in logic, if logic texts are illogical?

When there is so much to be done in learning to think better, why waste time on the fallacious "square of opposition," or the ponderous rules of the syllogism, with "distribution of terms"? Why not teach the first figure syllogism as "what is in the smaller is in the larger," the second figure as "what is outside the larger is outside the smaller," and the third figure as producing a case to be used later in refuting a general rule? A dilemma is two syllogisms side by side, connected by "or," and so on. All that is sound and useful in the ordinary deductive logic text can be taught in about half an hour. But then there must be weeks of practice, to make the student feel the formal structure in actual cases. Even that will not make him a logical reasoner. But it can be a step in the direction of clearer thinking. Though the symbolic logician may for his purposes quite properly define an abstract form of implication such that a true proposition is implied by all propositions, the beginner in logic needs to get a sense that not everything is evidence for everything else, and the truth of the conclusion is not a sufficient guarantee of the soundness of the process by which it has been arrived at.

But there is a larger educational problem. I do not wish to blame modern "progressive" education with faults that stem from human nature. But when logical thinking and mathematics are taught always in their "instrumental" context, in connection with actual concrete problems, the student, when he arrives in an American college, is unable to think abstractly. A mathematics teacher described the situation as a sort of "idiotization," by which students seem to have acquired rather less than common sense when they gather in a college mathematics class room. If you ask John Jones what is the slope of the floor, he will answer at once that it has none. But if you ask him the slope of a horizontal line, he looks blank. There is no transfer to new cases, because he never abstracts out the essentials. All abstraction is "vague abstraction" to him. His school training has tried to keep him in contact with "concrete fact" and free from formulas. The result is that he becomes a helpless victim of formula when he gets to the point where formulas are encountered. The American student then develops the engineer type of mind, that grabs blindly for a formula, and industriously puts in values. It never occurs to him that mathematics is invention and construction, creative generalization.

He would be horrified by the thought. The endless resourcefulness called for by a good mathematics text (Salmon's *Conic Sections,* for instance) is repugnant to him. He enjoys getting hold of a nice meaningless formula, and working it out for ten different sets of values. And someday maybe he will be an engineer, and able to use a formula somebody else discovered when he needs it in his business. Instrumental thinking in concrete cases, indeed!—but he will never even be a good engineer.

V

Professor Cohen says of scientific methods that no one can dictate to the expert in a given field, or furnish a methodology of discovery. But the expert is not often fully self-conscious of his own methods. He pauses to give us a lecture on scientific method, and it turns out to be a rehash of *clichés* vaguely remembered from some elementary logic text. Or he spends time and energy developing a theory novel to him about sense-data or observability, which reduplicates philosophical speculations long ago found wanting. I note a recent debate on the "true" color of an unexposed photographic film. Eddington has said that the scientist could never learn from the philosopher, but must come to his conclusions when forced to them by his own difficulties and his own modes of thinking. I think that what Eddington says is probably the truth, but not a compliment to the scientist. The French have been more aware of the problem of scientific method than we have, but have not gone far. A science of scientific methodology is a project for the future, complex and difficult.

Much of the actual progress of science is a blind hand-to-mouth procedure, dependent often on the discovery or invention of certain tricks of technique: a way of collecting gases over water, an achromatic lens, a Wilson cloud chamber. Scientific "fashion" decrees that all young scientists must at a particular time follow after the prevailing trend, on penalty of oblivion. Experimental results are twisted in interpretation by the survival of old theories, or popular beliefs, or new positivist jargon. Among so many techniques just what is *the scientific method?* Is there a scientific method? The actual attitude of most scientists is summed up in "I do not ask to see the distant scene, one step is enough for me." Those who praise "the scientific attitude of mind" quite often really mean the desirability of taking a philosophical attitude. There is science which is philosophical, and science which is mere technique. The scientists who are votaries of the latter are mere technicians, a credulous and dogmatic group when outside their own specialty. Nevertheless respect for evidence is a great thing

where found, and there are among our scientists today some men of high ability. We must all admire the magnificent cumulative results of scientific work. But perhaps we should say of science what has been said of the American public school system, "it is a marvelous achievement—almost miraculous, considering who is running it."

We must confine our further discussion here to one logical aspect, the problem of probable inference. I share Professor Cohen's preference for the empirical frequency theory of probability, as over the alternative *a priori* theory of equal probabilities. I would state a typical complete example of the frequency theory as follows: having found, among what are (*a*) probably fair samples from a collection, that, let us say, 70% have the quality *M*, it can be inferred (*b*) with some degree of probability that (*c*) probably and approximately 70% of the entire collection have the quality *M*, and therefore (*d*) the probability that any one member not yet examined will have it is 7 out of 10. Let us note that (*a*), (*b*), and (*c*) are three different probabilities, (*d*) merely another way of stating (*c*). As for (*a*), a sample is probably a fair sample when it has been carefully selected at random (the paradox is only an apparent contradiction), a feat which is very hard to perform well. But the probability (*a*) can be raised rather high by varied selection and avoidance of sources of bias. The probability (*d*) has a definite value actually measured, 7 out of 10. But the probability of the inference (*b*), which is the probable inference, is the real crux. Its value can often be estimated, and unfortunately it comes out rather low, even with carefully chosen fair samples, when the samples are few relative to the total size of the collection. Unfortunately, also, this is our usual situation with regard to the vast world of nature. I am therefore not convinced that the frequency theory is a sufficient basis for our degree of confidence in our scientific knowledge. Any such theory, *a priori* or empirical, is based on plural collections, but the natural world illustrates not so much collections, but rather systems.

By that, I do not mean that the natural world falls directly into the "deductive system form" of formal logic, which is, in large part, a mode of exposition. Nor do I believe that the "analysis of the given," which is an essential part of the work of science, is the taking of an objective continuum and splitting it into terms and relations (by "term," in this discussion, I of course mean not "name," but "object related"). We do not make the system in things. The world is, I think, objectively a group of relational systems, though our analysis may imperfectly represent those systems, often in a manner too atomistic. It also seems to me there is no all-

inclusive system, and there are, as Professor Cohen says (p. 72), very likely regions of indetermination in the natural world itself. Relations within a single system, taken of course qualitatively or in intension, are essentially or internally related to one another, accidentally related to relations outside the system. There is no sense in asking whether a relation is internally related to the terms it relates. It is the belonging together of relations with one another that is important.

Relevance is not born of human purposes, but is simply objective systematic relationship. For the Absolutist everything is relevant to everything else, "the flower in the crannied wall" again. For the symbolic logician, material implication (and formal implication) is so generalized, or taken in so abstract, though exact, a form, that a true proposition is implied by every proposition. Neither Absolutist nor symbolic logician has any account of relevance.

Relevance is, however, absolutely necessary for a proper account of induction. *A priori* there are an infinity of systems, considered as essential possibilities. In a plane, given three points, there are an infinity of curves passing through the three points. But the analogy does not hold about systems. If it did, verification would be impossible. Given three or four members of a system, the number of possible systems having those members is not infinite. It is usually very limited. This fact often makes it possible to exclude alternatives by a few observations, and determine rather quickly what is probably the system under investigation. In frequency probable inference one argues from a sample to something else like it, in systematic probable inference from evidences to other things quite different, but systematically related. This probability of systems is the important probability for probable inference, and hence for inductive science. A branch of science studies one, or a few, such systems. Formal logic, in particular symbolic logic, deals only with certain highly abstract characteristics and derivatives found in all systems. Even when it uses such names as implication, invariant, presupposition, it deals often more with the language in which we discourse about systems than with the systems themselves. It may get presupposition and implication mixed up, and relevance with irrelevance, its variables may turn out to be the real invariants, and it may have more languages about languages than a layer cake has layers, but symbolic logic holds great promise for future world-analysis. It could be that, except by such indirection as reference to what is sayable in language, the fundamental structure of systems in general may be difficult to state. Nevertheless, the essential characteristic of a spe-

cific system, namely, the internal belonging together of the fraternity of relations that compose it, relations spatial, temporal, causal, functional, and others, or, in other words, their mutual specific relevance, is just what is abstracted from in formal logical study, which turns systems into sets of isolated entities (logical atomism). Such formal logic is, therefore, as witness, for instance, Mr. Bertrand Russell's bewilderment, completely at a loss to explain the surprising success of actual inductive inquiry.

VI

Formal logic, Professor Royce used to maintain, was the science of order, the general science of systems and structures, of structural invariants. Logic is thus a generalized mathematics; quantity is important only because it can be so accurately ordered. One made use of symbols to get free from vague intuitions, and ensure rigor of proof. The fundamental exact science must of all things be exact. The logic of thought is an applied logic. It could be represented in symbols and diagrams, which are not themselves thoughts, at least of finite thinkers. Logical form is wider than the psychological processes of finite minds. Such was Royce's view.

But a long history has identified logic with forms of discourse. "Either-or" and its correlatives seem to belong to discourse rather than to objective fact. So it is true that recent symbolic logic, for which as a technical development I have great respect, has laid increased emphasis on linguistic considerations, and on nominalism, the latter mostly through Russell and the positivists. Fear of contradictions of type has made these logicians wary of saying even some very commonplace things. I doubt if difficulties of type are so much mere matters of language. Is it not a confusion of type to treat a relation like a thing, as well as a class like an individual? I wonder if it is not a confusion of type to treat a sentence as being a proposition? One must not confuse the *genres*. There is, for instance, the apparent contradiction of treating something defined in terms of a completed whole as being a part of that whole. If this is a contradiction, it affects all "organismal" philosophical theory, including Whitehead. I am disposed to deny the nominalist logical-atomist assumption that difficulties of type are linguistic. Objective difficulties of the same sort can also be found. For example, suppose knowledge affects action, then could I know the future completely? If I did, then my own actions would be part of that future, and yet could not themselves be definite until that future was complete. The knowledge of my own future action becomes a new cause to make me act differently. This seems to me a contradiction of type, yet not based on a quirk of language.

Thus while forms of meaningful discourse traditionally and today seem to belong to the field of logic, it is doubtful if they can be decided upon without considering forms of reality. I was struck by the discussions along this line in the second part of Husserl's *Logische Untersuchungen* as far back as 1913, and tried lecturing on him, but no one was then ready to pay any attention. I shall limit myself here to one illustration of another sort, which can be briefly outlined, yet is of considerable importance. Are there negative individual facts, or only the absence of positive facts? This might seem an unimportant distinction. But let us note that what does not exist can not be observed. And we are told, by some naïve folk who think they are going to eliminate the philosophers at one stroke, that statements about the unobservable are meaningless. Yet we do make negative statements. But the question is even more important, for the whole theory of forms of propositions turns on making the proper analysis here.

Professor Cohen says it is often a question of mere convenience whether your statements take a positive or negative linguistic form. I agree, but my problem is more fundamental, going behind the forms of words. Let me start, as a preliminary, by asking what is the meaning of the statement, "All men are mortal." Linguistically, this is affirmative. Mill and others have said it was an enumerative summary, "Socrates is mortal, plus Plato is mortal, plus, etc." But Socrates is not a necessary being, he might never have existed at all. This would not have affected the truth of the proposition, "All men are mortal." Therefore, this proposition is not about Socrates, and therefore is not enumerative. What would wreck this proposition would be the existence of an immortal man. This then is the essential meaning, the denial that a certain complex exists (not, of course, in all universes of discourse, but in the one you are talking about). A universal proposition is, then, existentially negative.

But how about a statement of simple fact, may that not be negative also? Are there, then, negative single facts? One might suppose that if such a fact exists, it could be observed. Can we do it? I could certainly observe that there is an elephant in this room. Can I observe "There is not an elephant in this room"? Or rather, since this is about all elephants, excluding them all from this room, let us take the case, "Jumbo, a specific elephant, is not in this room." Can I observe that? I would say we can not—for how can one observe what is not here? But can I not infer it, from what I do see, plus general truths about elephants—elephants are big and opaque? And is not the inferred negative fact still a fact,

as Mr. Bertrand Russell told me once? I would say no, not if you mean an individual fact of nature. I infer the absence of a fact.

Unlike Mr. Russell, I am no great admirer of the "principle of parsimony." Its regular use in philosophy gets rid of a lot of "metaphysical lumber," as Russell says, but it usually replaces mythology by sterility. Nevertheless I am troubled by the appalling multiplicity, the pullulation and superfoetation, of these supposed negative facts. At a given moment the moon is *not* ten miles from the nearest point of the earth; it is *not* ten miles, plus three hundred yards, one foot, and two inches; and so on, endlessly. Are these objective facts? Why not say simply there are no such actual facts? There are, I think, no negative individual facts, except as imaginary creations of discourse, but only the very real absence of certain described positive facts. And even if the individual negative fact existed, it could not be observed.

What, then, it will be asked, does an individual negative proposition stand for? It stands for nothing. But if it stands for nothing, both when it is true and when it is false, is it not meaningless? I am not so sure. It describes an imaginary combination of real qualities. A positive proposition stands for something when true, nothing when false, but does it become meaningless when false? Perhaps we should say a negative individual proposition stands for nothing when it is true and something when it is false. Or if that be too paradoxical, why not say, as Wittgenstein once suggested, every proposition is a double-barrelled thing, contemplating what would be the case if it were true and what would be the case if it were false. The negation of it reverses the direction; two negatives reverse twice, and you are back at the start. But Wittgenstein, like other logicians, symbolic and otherwise, has also assumed there were real negative individual facts, each incompatible with a corresponding positive fact, but present whenever it is absent. Let us examine what these could be.

It has been suggested, again I think by Bertrand Russell, that relations take terms in two ways, positive and negative. I do not really understand what this suggestion means. It seems to imply that everything in the universe is related to everything else by every possible relation, sometimes negatively, sometimes positively. Not merely that, but any dyadic relation, not symmetrical, relates every two terms in two ways. A relation as simple as "giving in trade with something to boot" relates five terms in as many as one hundred and twenty different ways. I wonder what happens to the symbolic logician's definition of a relation as the sets of terms it relates. No relational analysis can stand the strain of a theory

which asserts that everything is related to everything else in multiple ways by every possible relation.

But may it not be, rather, that an individual negative fact is a real complex, a set of terms plus a relation that does not relate them (or a thing and a quality it does not have)? A new positive fact can certainly come into being, a new complex. I can put the book on the table, or even the table on the book. The synthesis is more than the table, the book, and the relation of "being upon," for I can make two different combinations out of these constituents. But did I not begin with these constituents, and put them together? Might I suppose, then, that a negative fact could be turned into a positive fact by relating the terms to the relation? If so, then the relations that do this need in turn to be related to their relata—and we have the infinite regress which is the chief stock in trade of Mr. Bradley. It runs through all the destructive analysis of the relational view of things which makes up his book, *Appearance and Reality*. I see no way to escape Bradley here, except by a simple comment which refutes both Bradley and the view we started to criticize. What, pray, is a "relation that does not relate"? Is it not in the same class with a light that never shines, or a circle that is not round? It seems to me that a negative individual fact contains a self-contradictory element, and is therefore self-contradictory, and therefore does not exist. To say the positive fact does not exist is therefore not the same as saying the negative fact does exist. There are no such facts.

A universal proposition is, then, a proposition that denies the existence of a combination: "There is no immortal man," "There is no elephant in this room," "Jumbo is not here." All such statements are universal in force, not particular or individual. But of universal propositions there may well be decidedly different subtypes, some markedly positive in expressing necessity (these may have no genuine contradictories), or essential relevances and incompatibilities, more and more adequate specific generalizations about systematic connections. These are the significant scientific universal propositions. There may be some more or less accidental empirical generalizations, "All crows are black." But when it comes to individual "negative facts," though the propositions are in universal form, they are largely inventions of discourse, and are as numerous as anyone sees fit to invent them. Some such propositions may be important if true, "There is no God," "There is no planet beyond Pluto." Many are merely trivial, "At this moment there is no blue-eyed beetle sitting on top of the Washington Monument."

No universal proposition can be established directly by obser-

vation, for they are negative, and observation gives positive facts. They are established by aid of incompatibilities, often incompatibilities with what is positively observed. It would seem, therefore, that some incompatibilities must be known directly, incompatibilities between essential possibilities, not between pairs of actual existences, for incompatibles can not be observed coexisting, and making faces at one another. We must distinguish also, I think, between the reason for being and the reason for knowledge. To hold that everything that is compossible exists, and therefore that there is a reason for the non-being of any combination, a reason which is to be found in the incompatibility of it with something that does exist—that is a metaphysical thesis, Spinozist and Leibnizian. I doubt its truth. I grant there often is such a reason in a particular case, a reason why there actually *is not* an elephant in this room, though it might not be so easy to find out. But the reason why *I know* with high probability that there are no elephants in this room is comparatively rather simple. I have at hand all the necessary evidence in a look around the room—except the elephants, of course, which I must provide from elsewhere, and some generalizations, previously known, about the opaqueness and obtrusiveness of elephants, facts about qualitative incompatibilities. The more individual case, "Jumbo is not here," would most probably be arrived at by inference from the more general case: "There are no elephants here; there exists an elephant Jumbo; therefore he is not here." It is not universal truths as such which are hard to arrive at. It is the specific generalizations, significant because central key combinations, fertile in real implications and systematic entailments—that is what requires arduous scientific research.

A particular proposition, whatever its linguistic formulation, is always affirmative in force, and asserts the existence of something illustrating a certain combination of characters. The difference, I take it, between a particular affirmative proposition and an "individual" proposition is one of degree of precision of reference. Both are about individuals, not classes or classes-of-one, though we can specify there is only one individual of the sort described, and both claim existence of the objects and combinations described. (I do not altogether recognize, therefore, Russell and Whitehead's distinction of "existence with a shriek," and "existence upside down.")

I used to think that there must be "proper names" that connected thought with sense-experience, and directly and unequivocally denoted individuals, and lost all meaning when there was no such individual. These might be demonstrative pronouns, such

as "this," or a pointing finger. But I noted that even the pointing finger was not without meaning, as when I peer through the dark, trying to descry what is being indicated; on the other hand, the dog, seeing both the pointing finger and the object pointed to, yet does not connect the two. There are descriptions that characterize, and descriptions, more like "proper names," that tell us the road to an object, but neither lose their meaning if there be no such object. Affirmative statements containing them merely become false.

It is, I think, quite wrong to say that individuals are given directly in sensation, while universals are thought by concepts. Both are thought. A broad landscape may in a moment reveal vast detail, too rich to put in words. But Bradley's contrast of this glorious immediacy of experience with logic, as a "ballet of bloodless categories," seems to me easily misleading. It is indeed true that to live only on borrowed experience, to dry up the sources of emotion, is to empty life of value, but it is not a proper preparation, either, for creative logical thought. The contrast is not between logic and life, but between a muddled life and a clear one. Sensation, as various philosophers from Kant to Dewey have insisted, is always an active interaction, not a datum or a passive reception. The world is never simply given to us in observation. We observe how it looks to us, but we are always like the butcher who has his thumb on the scale. We need thought to eliminate this bias. We succeed. We need not assume, like the idealist, an Absolute Butcher with an infinite thumb. We see a thing at a place from a place, and we infer what it really is and really was, before we observed it. And other observers confirm us—though they do not see our datum. We do this all the time. We make mistakes, indeed, and we correct them. Physicists discuss the Heisenberg principle, and infer that something can not be, because we can not observe it without changing it. And I say to myself, "Is it not always so? Why this peculiar demand here for something 'given' to us unchanged?"

Looking over what I have written, I have wondered whether most of it was not too simple, obvious, and inevitable to need saying. And then I realized also that I was disagreeing with almost everybody, though I hope not too much with Professor Cohen. I do not want to refute people. That starts an argument, and the arteries of thought get hardened. Argument is waste motion, except when it brings out some overlooked but relevant consideration. But, of course, the assemblage of all the relevant considerations is the great task of all philosophy, and the value of dialectic.

But let me try to sum up the general philosophy of logic here being expressed. It agrees with Kant in its emphasis on thought as highly synthetic and constructive, highly inventive. Thought is analytic, indeed, in the inductive separation of the fields of experience into systems. But the synthetic aspect of thought is found in all real deduction. We may hide it in a definition, as Russell did with "mathematical induction," but that is a bit of a trick. We build before we "prove." Our syntheses do not involve too great a pre-established harmony between the mind of man and the world. Charles Peirce said it is astonishing that man ever hits on the right hypotheses. Maybe, but I doubt it is so incredible, or that we can not get behind superficial appearances. The essentially possible hypotheses are indeed, to begin with, infinite in number, but a few empirical experiences quickly bring the set of systems that need to be considered, at any given level of scientific advance, down to quite manageable proportions. It is for this reason that empirical observation is absolutely necessary, and the world can not be inferred *a priori*. Call this view, if you will, a rationalist realism; it is also an empiricism, if that is not taken to imply the world is "given" to us, and we do not need to think.

The forms that valid deduction must be based on, are objective forms, general system characters, and not forms of discourse. There are in addition epistemological forms of discourse. But forms of thought are secondary, subordinate to general system forms, the general morphology of the world. Systematic connections are specific to their own fields, and are not themselves logical. They merely have certain abstractable characters, that formal or symbolic logic studies. It seems to me completely false that all system is logical, and the sciences are merely symbolic logic "with the *x's* and *y's* replaced by carbon and hydrogen."

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BOOK REVIEW

Painting and Painters—How to Look at a Picture. From Giotto to Chagall. LIONELLO VENTURI. New York: Charles Scribner's Sons. 1945. xx + 250 pp. $3.50.

Professor Venturi's book is a good illustration of how an otherwise sensible critic and art historian may be lead into redundancy, irrelevance, and, occasionally, sheer nonsense by the very thing that is designed to give his work a depth of understanding denied to the unphilosophical: a pre-established "system of criticism."

One might say simply: let Venturi instruct and enlighten where he is able, and ignore the "purple passages." Unfortunately Professor Venturi will not let the reader forget them. At the very outset he introduces the novitiate to his system and conscientiously applies it throughout the remainder of his book. Moreover, since it is part of his pedagogical aim to introduce his reader to art from the standpoint of his theory of art, it would be impossible to evaluate the book in terms of its own manifest purpose, if the reviewer, in the interest of brevity, neglected to discuss the theory itself.[1]

"The expression of an individual preference," says Venturi, "is always arbitrary." From statements of preference, therefore, there is no appeal: there is no such thing as a "right" or "wrong" preference. But a judgment of *criticism* "must be either right or wrong." *Ergo,* it is not an expression of preference. It is, rather, based on "the objective quality of a work." When one asks what this quality is, Venturi replies that it is the quality of being "a work of art."

Though in a sense this really *is* Venturi's answer, he seems partially aware that something more is wanted of a theory of esthetic judgment. He therefore proceeds to contrast his own "system of criticism" with two others, one old and one new, both of which he rejects. The "old system" considers the form of a work of art simply as a means to the expression of subject-matter; on the other hand, the system "prevailing in our time" reduces a painting, say, to its essential visual elements. Both are false. In their stead Venturi offers a third "system of criticism" based upon a distinction between subject-matter and content and the "unity" of content and form.

The subject-matter of a painting is *what* the painter has reproduced; the content is *how* that subject-matter has been conceived. But when one speaks of how a thing is conceived, according to Venturi, one is really speaking of form. *Ergo,* form and content are identical.

To the careful reader this bit of verbal sleight-of-hand will not remove the old distinction between form and content; nor will it circumvent the difficulties which the distinction has appeared to

[1] I do not wish to suggest that the critic is not entitled to hold a theory of art, or that he should withhold it from his reader. Certainly, in principle, at least, the more profound—perhaps, the more philosophical—a critic is, the better. But if much is gained from a sound critical theory, immeasurably more harm is done, if the theory is radically mistaken, than if the critic had consented to treat works of art at a much less philosophical level. Particularly is this true in the case of a work such as the present one whose purpose is to reach the lay reader who, presumably, simply wishes to be told "how to look at a picture."

many to involve. It merely calls the terms in question by different names.

In any case, Professor Venturi thus still has to show how some subject-matters are "artistic" and others are not. His answer is the common one that neither the subject-matter nor the content (form) can be detached from the "whole of a painting without destroying it." The work of art is a unity of these elements "in one harmonious fusion." This unity constitutes an "individual form" (*sic*) wherein resides the esthetic or artistic quality. It seems, then, that Venturi is a formalist, in the modern extended sense, after all. But he gives another twist to the view: the individual form is always a disclosure or expression of the personality of the artist—though not of the man. It is this revelation of personality, it turns out, which *is* the work of art, and which, *a fortiori*, is the object of the critic's attention.

Let us see how Venturi applies the system of criticism to individual art-objects. Consider, for example, his analysis of Giotto's *Joaquin and the Shepherds*. In this picture there are the following objects: three men, a little dog, some small sheep, a sheepfold, a rocky mountain sprigged with trees, the sky. The first thing, according to Venturi, is to discard prejudice: the naïve realism which finds a discrepancy between the proportions of the men and the (very) little sheep. Giotto is not trying to imitate nature. By emphasizing the smallness of the sheep Giotto was simply drawing attention to the men. "Men being more significant had to be larger." Was Giotto's "reasoning" correct? There is no answer. It is the total esthetic result that counts, not the individual proportion or disproportion which are "but components of the work" (p. 11). Similarly with the mountain. The mountain emphasizes the figures of the men, not only by contrast, as do the sheep, but "actively." The felt qualities of the mountain—heaviness, solidity, hardness, etc.—are made apparent through a skillful use of chiaroscuro—the contrast or gradation of light and dark, independently of the different colors employed in their production. This *plastic effect* throws into greater relief the figures of the men. This emphasis, together with a skillful treatment of the folds of the men's garments, gives to the appearance of the men a depth and solidity in turn which is similar to that of the mountain. Giotto thus achieved a concreteness and articulation with respect to his figures which powerfully and movingly expresses the emotions and feelings he sought to convey.

So far so good. Here there is little that could not be said on any critical system. Venturi has called attention to just those formal elements which, exciting in themselves, also vividly express

and evoke the feelings of "sympathy, devotion and love" which are objectified in the experience of Giotto's masterpiece. But Venturi goes on to point out that these (and other) components "are but the expression of the artist's personality" (p. 32). "Giotto was a man of the people and had the soundness and directness of the people. He understood St. Francis's message of humility and love —and was deeply rooted in the earth" (p. 32).

Here, it seems to me, Venturi's comments are as misleading and/or redundant as the theory behind them. Either the work of art itself expresses all we know or need to know of the artist's personality, in which case it, together with the form (content), etc., are fused into a harmonious whole which needs no external commentary, or it does not, in which case there is no fusion and we must look beyond the picture itself to find its artistic value.

Actually Venturi's theory forces him to fall between two schools of art criticism. His emphasis on "individual form," together with his competence as a critic and his sound instincts as an appreciator, lead him to analyze illuminatingly the elements and relations which make the various paintings which he discusses moving or otherwise. Here his analysis directs the attention of his reader to the painting itself. But the necessities of his system of criticism also force him invariably to go beyond the felt qualities of the painting to a forced and usually superfluous disquisition on such things as the "moral consciousness," "the universal idea," "the eternal values" which he finds in a still-life or landscape by Cézanne. These "values" constitute the "moral beauty" of Cézanne's personality to which the paintings themselves supposedly provide a springboard.

Professor Venturi's book, then, like many others of its type, contains much that is truly helpful by way of analysis of plastic values and the techniques and means used to realize them. He helps the reader to *see* the painting in question more adequately and more discriminatingly than before. Moreover, since it deals, in most cases discerningly and sympathetically, with 53 well-selected and varied examples of paintings from most styles of art from Giotto to the present day, the book has a critical scope which greatly enhances its value. Its defects, which are considerable, are due almost wholly to an art theory whose merits are those of tautology and whose defects are those of misleading irrelevance. These defects show up most glaringly in Venturi's analysis of Picasso, whose "personality" is so much anathema to him that it prevents doing justice to the evident expressiveness as well as the formal excellence of Picasso's work.

The plates are of much less help than they should be because of

their neutral tones. It is impossible to grasp the point of many of Venturi's analyses of the use of color in the paintings when there is no opportunity to see for oneself the objects to which the analysis is directed. And Booth Tarkington's "Preface" is not of much aid to the reader who is desirous of assistance in looking at pictures, though it is doubtless useful to Venturi's publishers.

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BOOK NOTE

What is Life? ERWIN SCHRÖDINGER. Cambridge: Cambridge University Press. New York: The Macmillan Company. 1945. viii + 91 pp. $1.75.

This little volume is an odd mixture of informative scientific exposition and unresolved paradox. It combines a clear though brief explanation of the stability of the physical basis of biological heredity in terms of a quantum theory of atomic and molecular organization, with a curious argument for the reality of a single, pervasive consciousness of which plural personalities are simply the illusory appearance.

The first part of Schrödinger's discussion is based on two assumptions: that the regularities in nature disclosed by classical physics are merely statistical in character; and that the stability of biological genes, since they are constituted out of a relatively small number of atoms, can not be understood as simply a statistical effect. A quantum theory of molecular structure is therefore outlined, and it is shown how on that theory the genes can be regarded as strictly deterministic mechanisms. Though often taken as the ground for rejecting a deterministic conception of nature, quantum theory in Schrödinger's hands thus serves as a foundation for a deterministic analysis of the behavior of at least a part of the biological organism.

On the basis of this discussion Schrödinger concludes that our bodies in general function as pure mechanisms, obeying deterministic laws of nature. However, he also maintains, "on the incontrovertible evidence of direct experience," that we are free agents and control the behavior of our bodies. But according to him, "the only possible inference" from these premises is that we also control the motions of the atoms constituting our bodies. In obtaining this capital conclusion the biologist is thus said to come as close as he can get to a proof of God's existence and human im-

mortality. For that conclusion commits us to the view that each of us is God. However, "consciousness is never experienced in the plural, only in the singular," and the idea of a plurality of separate egos arises only because of the plurality of similar bodies with which "the pluralization of consciousnesses" is associated. But since the assumption of such a plurality of "souls" leads to absurdity, Schrödinger maintains that at bottom there can be only a single consciousness, and "what seems to be a plurality, is merely a series of different aspects of this one thing, produced by a deception (the Indian MAJA)." Such, then, are the strange adventures of one Nobel Prize winner in physics in other domains than those in which he has established his professional competence.

E. N.

NOTES AND NEWS

There will be a joint conference of the American Philosophical Association and the American Association for the Advancement of Science on the philosophy of science on March 28, 1946, in the Municipal Auditorium, St. Louis, Missouri. The program is as follows:

9:30 A.M. *Symposium on Theory and Prediction in Science.* Chairman, Professor Charles Morris.

Brief Formulation of the Problem and Issues: Professor Rudolf Carnap, University of Chicago.

Participants: Professors A. C. Benjamin, Max Black, Philip Frank, Carl Hempel, Henry Margenau, Ernest Nagel, F. S. C. Northrop, Hans Reichenbach, Alfred Tarski, Norbert Wiener.

2:00 P.M. *Symposium on the Philosophy of Biophysics.* Chairman, Professor F. S. C. Northrop.

Papers: "The Particle Physics Approach to Biology" by Professor Raymond Zirkle, University of Chicago; "The Field Physics Approach to Biology" by Professor H. S. Burr, Yale School of Medicine; "The Problem from the Standpoint of Theoretical Physics" by Professor Henry Margenau, Yale University.

"The American Philosophical Association wishes to express its deep appreciation of the generous financial aid given to the Association by the Rockefeller Foundation in planning and arranging for this joint conference." Cornelius Krusé, Secretary.

The postponed meeting of the Phenomenological Society will be held at eight o'clock, Saturday evening, April 27, 1946, at Hunter College in New York City. The general theme will be Phenomenology and Psychology. Papers will be presented by S. E. Asch, Aron Gurwitsch, Kritz Kaufmann, and V. J. McGill. All interested persons will be welcome.

The second series of Woodbridge Lectures will be delivered at Columbia University, April 4, 5, 10, 11, and 12, 1946, by George Plimpton Adams, Professor of Philosophy at the University of California and Visiting Professor at Columbia University during the spring semester of 1946. The general subject of the lectures is "Man and Metaphysics." The titles of the individual lectures are "Life and Knowledge," "Man's Metaphysical Sense," "The Mind's Possessions," "The Mind's Meanings," and "The Mind's Excursive Power."

At the meeting of the American Association for the Advancement of Science, March 27–30, 1946, at St. Louis, Missouri, Professor Irwin Edman will give the annual address as a representative of the National Society of Phi Beta Kappa. The title is "Science and the Dream of Happiness."

TO THE EDITORS OF THE JOURNAL OF PHILOSOPHY:

Professor Dewey's discussion in this JOURNAL ("Peirce's Theory of Linguistic Signs, Thought, and Meaning," Volume XLIII, 1946, pp. 85–95) of the relation of my monograph, *Foundations of the Theory of Signs,* to Peirce's semiotic may have given to some of your readers the impression that my analysis claimed to be a presentation of Peirce's views. This was not the case. The result may be that the central problem which bothered Dewey (the problem of the relation of a behaviorally oriented semiotic to the work of such "formal logicians" as Carnap) will be missed by his focusing of attention on the historical problem of how far my views do or do not agree with those of Peirce. My monograph certainly did not deal adequately with the place of "logical analyses" in a behavioral theory of signs. I have tried to do more justice to this problem in my book, *Signs, Language, and Behavior,* which is to appear in the next few weeks.

CHARLES MORRIS

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